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(54) Mobile communication devices

(57) A mobile communication device has a housing 1 containing battery and electronic component compartments 7. Located along a central axis of the housing 1 is a spring mounted roller 4 to which is attached a flexible liquid crystal display 9. The housing 1 contains a com-

partment between the roller 4 and the outer wall of the housing 1 for storing the display 9 in a retracted position. An elongate slot 12 extends axially along the housing 1 such that the display 9 can be pulled through the slot 12 by a user to a withdrawn position in which the display 9 is visible to the user.

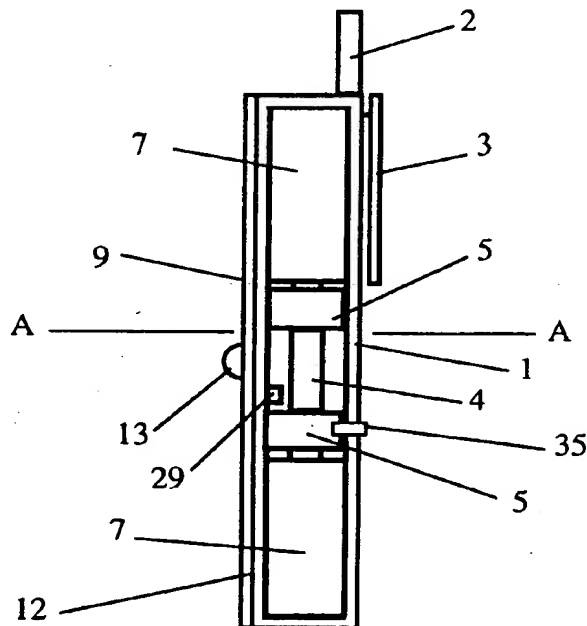


Figure 1

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## Description

The present invention relates to mobile communication devices and more particularly, though not necessarily, to mobile telephones.

Mobile telephones are becoming increasingly popular due in part to the dramatic miniaturisation of mobile telephones which has occurred over the past decade. However, there remains a desire to further miniaturise mobile telephones whilst also including additional features, e.g. increased memory. A limitation on the scale of miniaturisation which can be achieved is the necessity to provide an electronic display which is large enough to provide information (e.g. alphanumeric characters and icons) to the telephone user. The need for displays also significantly affects the weight and design of mobile phones. Typically, phone displays are conventional liquid crystal displays (LCD) which may occupy up to 25% of the front surface area of the telephone.

It is an object of the present invention to provide a mobile communication device which overcomes or at least mitigates certain of the aforementioned disadvantages.

According to a first aspect of the present invention there is provided a mobile communication device comprising a flexible electronic display and a housing for containing the display, wherein the display is movable between a retracted position within the housing to an in-use position where the display is visible to a user.

The provision of a flexible display may significantly reduce the contribution which the display makes to the size and weight of the device. It also becomes possible to provide a much larger display area than is possible with conventional solid LCD's. Device optimisation may provide for both reduced weight and size and increased display area. The present invention may also give increased flexibility to device design as the design is no longer constrained by bulky and rigid conventional LCD's.

Preferably, the flexible electronic display is a flexible liquid crystal display.

Preferably, the display is coupled via a spring mounting to the housing, wherein the display can be withdrawn from the housing against the action of the spring mounting and, after withdrawal, the display can be retracted into the housing under the action of the mounting. The mounting may also comprise locking means for locking the display in the in-use position and associated release means. The mounting may comprise switch means, for example associated with the locking means, for electrically activating the display when it is withdrawn from the housing. It will be appreciated that such switch means may provide for reduced power consumption, an important consideration where battery size and life are critical.

The display may be divided, in the direction of withdrawal, into a number of segments each of which is independently powered. The mounting for the display may

be arranged such that the display can be withdrawn, and possibly retracted, segment by segment so that only those segments which the user requires to see are visible and powered. This provides for further economy of power consumption.

The display may be provided with one or more touch sensitive elements or 'buttons' which are accessible to the user when the display is withdrawn. It will be appreciated that the provision of these elements may reduce or eliminate the need for mechanical buttons elsewhere on the mobile device and may therefore provide for further economies of size and weight. These elements may be provided directly over active areas, over non-display areas, or over a combination of both. Where the elements are provided over active areas, the display controller may be arranged in use to display in those active areas icons or messages which relate to the function of the element. For elements over non-display areas, permanent legends may be displayed under (if the elements are transparent) or on the elements. Typically, the display may comprise non-active display areas which lie over the routes which the row driver lines for the display are grouped, e.g. along the edges of the display in the direction of withdrawal, in which case these areas may provide suitable locations for touch sensitive elements with associated permanent icons or legends.

Preferably, the housing comprises first and second compartments for containing the retracted display and electronic components of the device respectively. More preferably, the second compartment is substantially contained within the first compartment. For example, the housing may be substantially cylindrical, with the first compartment lying coaxially around the second compartment. Alternatively, the first compartment may be substantially U-shaped with the second compartment being located in the centre thereof.

In order to provide support for the flexible display there may be provided a support member which can be extended from a withdrawn position in which it is contained within or close to the housing to an extended position in which it supports the display. In one embodiment, this support member may also provide an extendible antenna for the device.

The device may have a transparent window provided in the housing and through which an active portion of the display may be viewed.

The present invention is applicable in particular to mobile telephones although it will be appreciated that other mobile communication devices such as pagers and integrated mobile phones and personal digital assistants (PDA) also fall within the scope of the present invention. In the case of mobile phones, the display mounting mechanism may comprise on/off switch means which is activated when the display is withdrawn or retracted and which causes the phone to be switched on or off. In certain circumstances it may be unnecessary for the user to see the display in order to use the phone, e.g. when an incoming call is received, and the

phone may therefore comprise additional switch means on the exterior of the housing.

According to a second aspect of the present invention there is provided a mobile telephone comprising a flexible electronic display and a housing for containing the display, the display being movable between a retracted position within the housing to an in-use position where the display is visible to a user, the telephone further comprising switch means actuable, by movement of the display from the retracted position to the in-use position upon receipt of a telephone call, to take the telephone off-hook.

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 shows a cross-sectional side view of a mobile phone having a flexible display, with the display in the retracted position;

Figure 2 shows a side view of the phone of Figure 1 with the display in the withdrawn position;

Figure 3 shows an enlarged cross-sectional view through the phone of Figure 1 taken on the line A-A; Figure 4 shows a display mounting mechanism of the phone of Figure 1;

Figure 5 shows a cross-sectional view through the mounting mechanism of Figure 4 taken on the line B-B;

Figure 6 shows in more detail a display of the phone of Figure 1;

Figure 7 shows a first modification to the phone of Figure 1;

Figure 8 shows a side view in partial cross-section of the modification of Figure 7; and

Figure 9 shows a cross-sectional view of a mobile phone according to a second embodiment of the present invention;

A mobile phone is shown schematically in Figures 1 to 5 and comprises a circularly cylindrical housing 1 of rigid plastics or the like. An antenna 2 (e.g. telescopic or fixed) and a belt clip 3 are provided in a known manner. In certain cases, the antenna 2 may be internal to the housing 1. The housing 1 contains a cylindrical roller 4 which is mounted coaxially within the housing 1 such that the roller 4 can rotate about the central axis of the housing 1. The mounting for the roller is shown in more detail in Figures 4 and 5 and comprises a pair of cylindrical mounts 5 into which respective ends 6 of the roller 4 are located, the ends 6 being rotatable within the mounts 5. Projecting ends of the roller are received by locating recesses (not shown in the drawings) provided in the opposing surfaces of adjacent compartments 7, which compartments contain the battery supply for the phone and other electrical components. The mounts are fixed to the opposing cylindrical compartments 7. As is shown in Figure 5, each mount 5 contains a spirally

wound spring 8 which is secured at its outermost end to the inner surface of the mount 5 and at its innermost end to the roller 4.

A flexible rectangular LCD display 9 is electrically and mechanically coupled to the centre of the roller 4 by a short length of ribbon cable 10, the roller 4 and the mounts 5 providing a spring mounting for the display 9. The display 9 is also secured to the mounts 5 in the same axial plane as the coupling to the roller 4 (along regions A and B as shown in Figure 4). The mounts 5 bias the roller so that, when no external force is applied to the display and the mounts are not locked (see below), the mounts tend to wrap the display 9 around the mounts 5 and the compartments 7. An elongate slot 12 extends axially along the housing 1 and when the display 9 is fully retracted only a small tab 13, fixed to the display, projects through the slot 12. In order to withdraw the display 9, a user must grasp the tab 13 and pull the display 9 through the slot 12 against the action of the mounts 5. A lock 35 is provided for the mounts 5 so that when the display 9 is fully withdrawn automatic retraction is prevented. The lock 35 also prevents the display 9 being damaged due to over withdrawal. The lock 35 is engaged automatically following withdrawal of the display 1 and is released by the user pressing that portion of the lock 35 which projects from the housing 1.

A flexible LCD suitable for use in the embodiment described here is disclosed for example in US4,948,232. A typical layout for the display 9 is shown in Figure 6. That part of the display 9 which is located above the line 14 is always contained within the housing 1 and is the location for the row and column drivers of the LCD pixels. Column drivers 15 are located in the central region of the display 9 whilst the row drivers 16 are located at the two end regions. This arrangement allows the row driver connections to be located along opposing edge regions 17 of the display 9. Whilst these edge regions 17 are unusable as active LCD display areas, permanent icons 18 overlaid with a matrix of transparent touch-sensitive elements (not shown) can be located there. In use, functions indicated by the permanent icons are activated by touching the overlying elements.

The display 9 is coupled to a switch 29 within the housing 1, the switch 29 being switched from an off-condition to an on-condition when the display is withdrawn from the housing 1. In the off-condition, the switch isolates the display 9 from the battery supply whilst in the on-condition power is supplied from the battery supply to turn the display 9 on. When an incoming call is received, withdrawal of the display 9 and the consequent actuation of the switch 29 also causes the phone to be taken 'off-hook'. That is to say that the telephone is activated to enable the user to hear and reply to the caller.

Transparent touch-sensitive elements (not shown) are also overlaid on the active areas of the display 9. In use, icons or text 20 is displayed by the control software under the icons and again functions are activated or in-

formation entered by touching these elements.

As is indicated by the dashed line 21 in Figure 6, the display 9 can be subdivided into a number of segments 22 (in this case two) each of which is backlight independently. The outermost segment 22b may for example be used to display the number of an incoming call or the number of a dialled outgoing call. The mounting for the display 9 may be such that the display lock operates when only the outermost segment 22b is withdrawn from the housing, causing this segment 22b to be backlight. If it is necessary to view the innermost segment 22a, the lock may be released and the display 9 withdrawn further with backlight being supplied to the segments in sequence as they appear. In general, the most used areas of the display 9 are located on the outer segment whilst the least used areas are located on the inner segment.

Figure 7 shows a modification to the phone of Figure 1 and in which the housing 1 is provided with a transparent display window 23, adjacent to the slot 12. This window 23 allows a user to view the outermost segment 22b of the display 9 without having to withdraw it through the slot 12. Additionally, the antenna 2 of the phone of Figure 1 is replaced by a folding antenna 24 which can be folded (position 'F') against the housing 1 or can be unfolded (position 'U') to provide support for the display 9. Figure 8 shows a side view of the modified phone of Figure 7 (with a cross-section taken through the housing only) and in particular shows the double-sided backlighting utilised. The transparent backlighting strip 31 of the display 9 is attached to the inner surface of the flexible LCD portion 32 so that the outermost display segment 22b is backlight from both sides. This allows the outermost segment 22b to be viewed from below (with reference to Figure 8) through the window 23 when the display 9 is retracted and from above when the display 9 is withdrawn.

Figure 9 shows an alternative embodiment of the present invention in which the phone housing 25 is rectangular in cross-section. A generally U-shaped compartment 26 is provided within the housing 25 for storing the display 27. The battery 30 and other electrical components 31 are contained in a central compartment 28 of the housing 25. The display 27 is arranged to be spring mounted within the housing 25 so that it can be retracted thereinto when not in use.

It will be appreciated by the skilled person that modifications may be made to the embodiments described above without departing from the scope of the invention. For example, the flexible LCD display may be replaced with a simple display comprising a sheet of electroluminescent (EL) plastics material having an opaque backing sheet attached thereto. Alphanumeric characters are printed on the front of the EL sheet and the display is electrically divided into segments so that each segment can be individually illuminated to highlight the characters printed on the segment. Such a display may be sufficient for indicating, for example, the operating

mode of the telephone, e.g. incoming call received, calling, stand-by etc. Alternatively a flexible display making use of electronically addressable ink material may be used. Such a display is described for example in "Electrophoretic Ink: A Printable Display Material", B. Comiskey, J.D. Albert, J. Jacobson, Society for Information Display, May 1997 Digest, pp. 75-76, (ISSN0097-0966X/97/2801-0075).

## Claims

1. A mobile communication device comprising a flexible electronic display (9,27) and a housing (1,25) for the display (9,27), wherein the display (9,27) is movable between a retracted position within the housing (1,25) and an in-use position where the display (9,27) is visible to a user.
2. A device according to claim 1, the electronic display (9,27) comprising a flexible liquid crystal display.
3. A device according to claim 1 or 2 and comprising a spring mounting (4,5,8) coupling the display (9) to the housing (1), wherein the display (9) can be withdrawn from the housing (1) against the action of the spring mounting (4,5,8) and, after withdrawal, the display (9) can be retracted into the housing under the action of the mounting (4,5,8).
4. A device according to claim 3, wherein the mounting (4,5,8) comprises locking means (35) for locking the display (9) in the in-use position and associated release means (35).
5. A device according to any one of claims 2 or 4, the mounting (4,5,8) comprising switch means (29) for electrically activating the display (9) when it is withdrawn from the housing (1).
6. A device according to any one of the preceding claims, wherein the display (9) is divided, in the direction of withdrawal, into a number of segments (22) each of which is independently powered.
7. A device according to claim 6 when appended to claim 3, wherein the mounting (4,5,8) for the display (9) is arranged so that the display (9) can be withdrawn segment by segment so that only those segments (22) which the user requires to see are visible and powered.
8. A device according to any one of the preceding claims, wherein the display (9) has one or more touch-sensitive electronic elements which are accessible to the user when the display (9) is withdrawn.

9. A device according to claim 8, wherein the display (9) comprises row driver lines extending along edge regions (17) of the display (9) in the direction of withdrawal of the display (9), these edge regions (17) comprising non-active display areas, touch-sensitive elements being provided at these edge regions (17) together with associated permanent icons (18). 5
10. A device according to any one of the preceding claims, wherein the housing (1,25) comprises a first compartment (26) for containing the retracted display (27) and a second compartment (28) within the first compartment (26) for containing electrical components, wherein said components are substantially surrounded by the retracted display (27). 10 15
11. A device according to claim 10, wherein the housing (1) is substantially cylindrical and the first compartment is a substantially annular space defined by the inner surface of the housing and said electrical components. 20
12. A device according to any one of the preceding claims, wherein the housing (1) has a transparent window (23) provided therein through which an active portion (22a) of the display (9) may be viewed. 25
13. A device according to any one of the preceding claims, the device being a mobile telephone, and comprising switch means arranged to be activated when the display (9) is withdrawn from the housing to act as an 'off-hook' switch for the telephone. 30
14. A mobile telephone comprising a flexible electronic display (9,27) and a housing (1) for containing the display, the display (9) being movable between a retracted position within the housing (1) to an in-use position where the display is visible to a user, the telephone further comprising switch means (29) actuable by movement of the display (9) from the retracted position to the in-use position upon receipt of a telephone call to take the telephone off-hook. 35 40 45 50 55

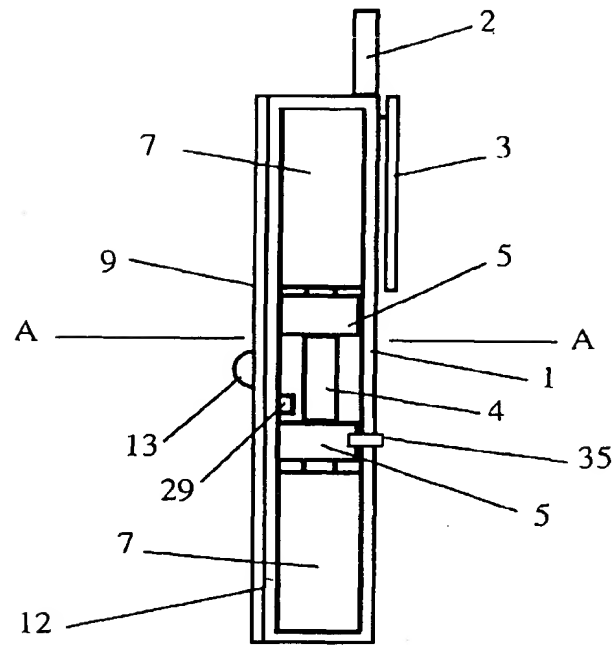


Figure 1

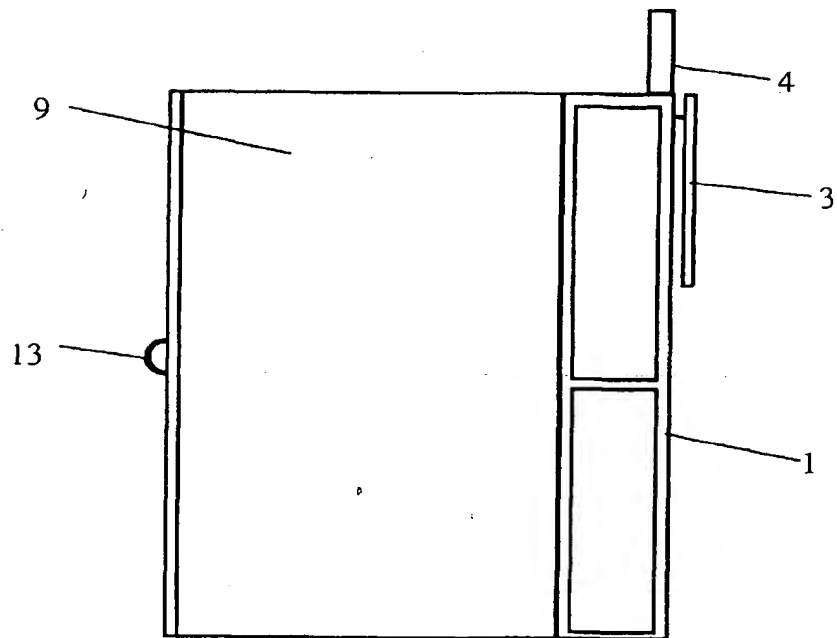


Figure 2

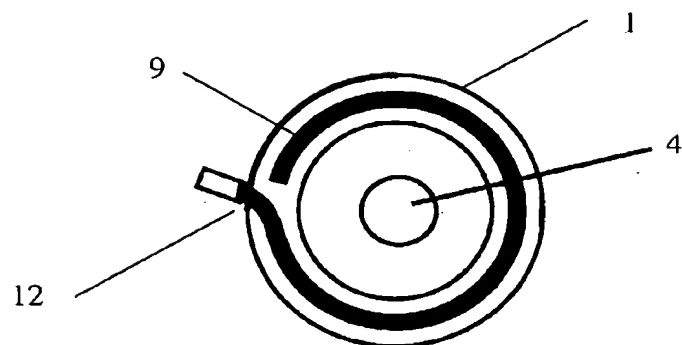


Figure 3

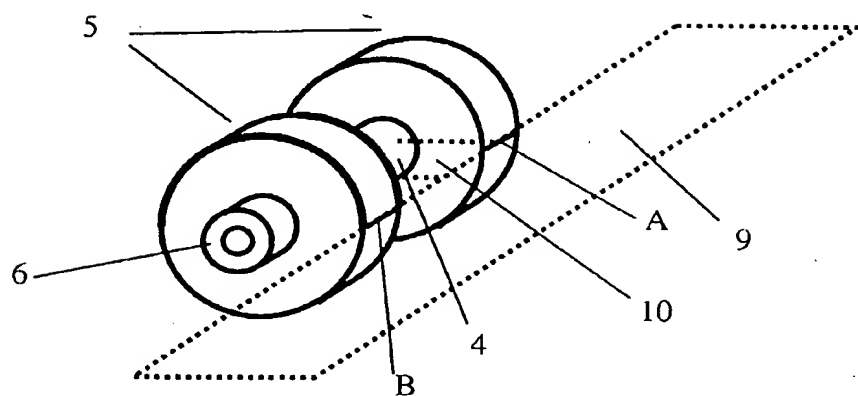


Figure 4

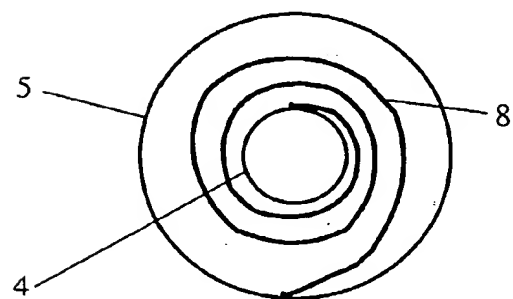


Figure 5

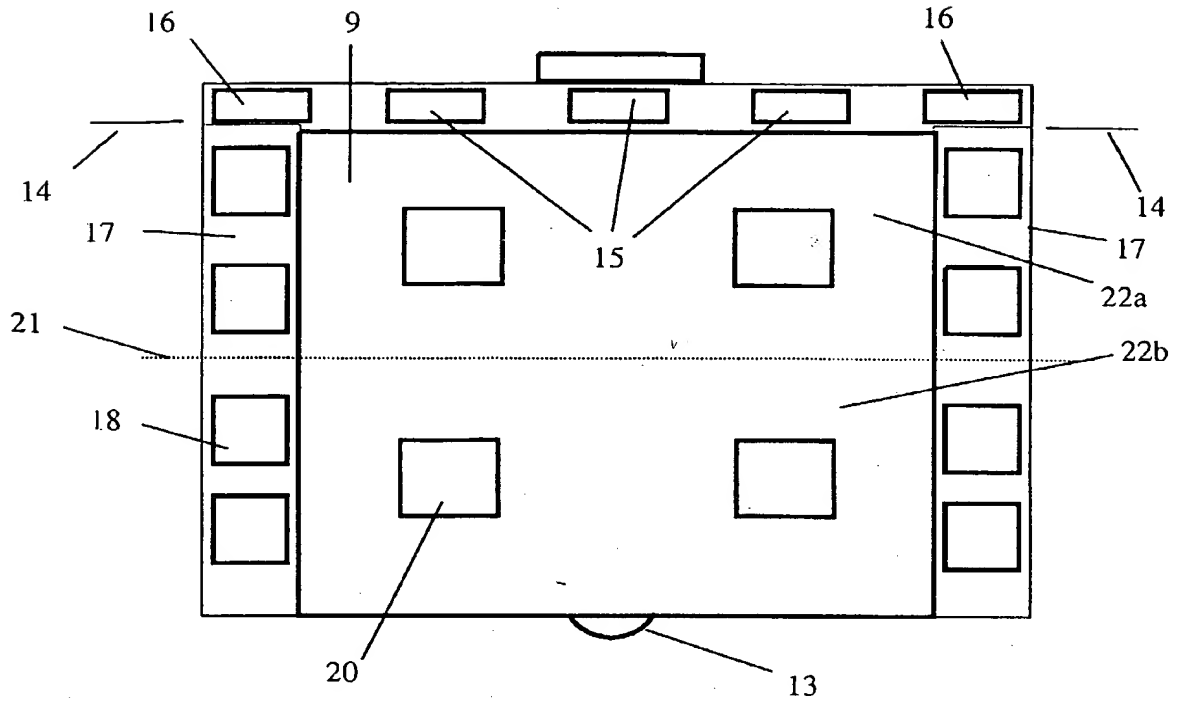


Figure 6

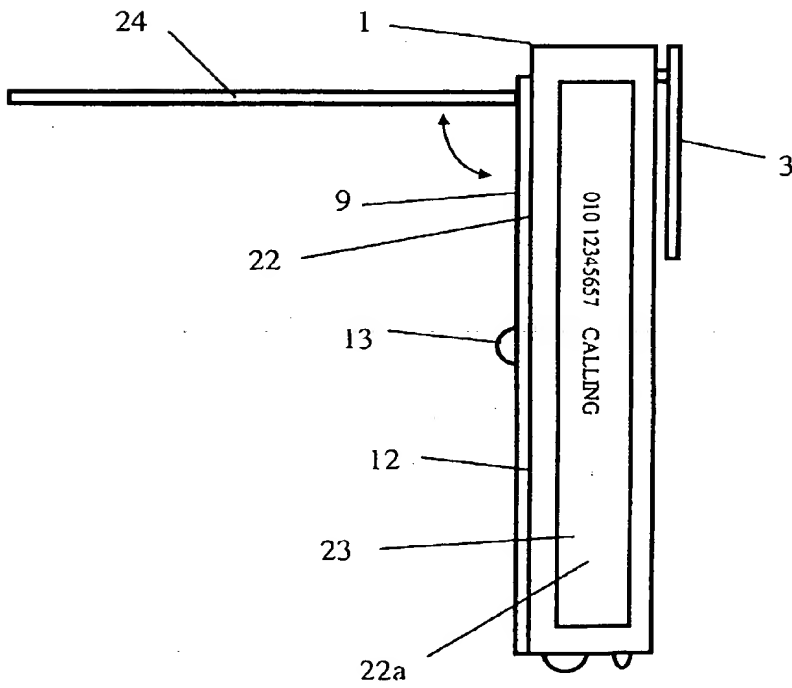


Figure 7



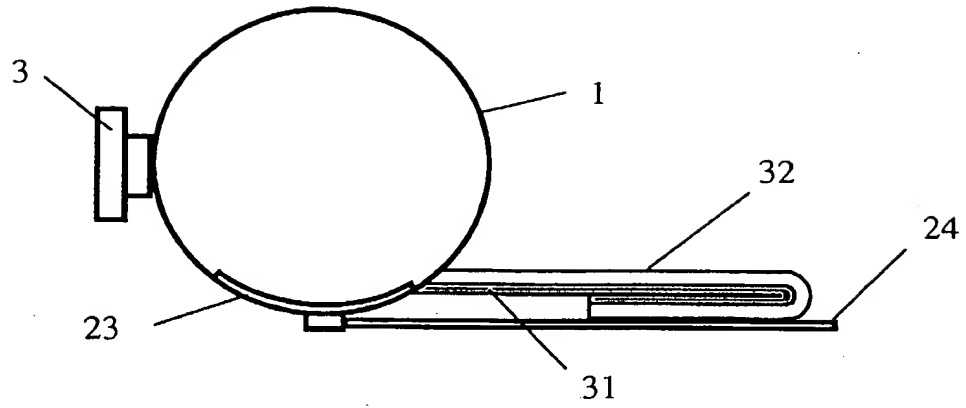


Figure 8

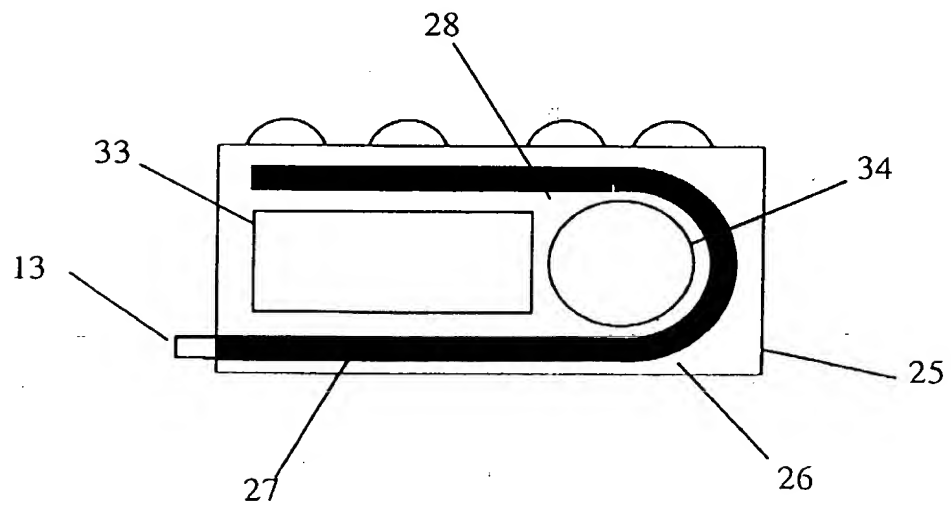


Figure 9

## \* NOTICES \*

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[The technical field to which invention belongs] this invention relates to the fold-up formula display with a carried type telephone.

[Description of the Prior Art] It folds up conventionally and formula display is proposed. For example, it is proposed by JP,5-61423,A etc.

[0002]

[Problem(s) to be Solved by the Invention] However, such conventional fold-up formula display has the problem that a miniaturization is fully impossible. this invention aims at the thing equipped also with the function of a carried type telephone for which it folds up and formula display is offered while it can miniaturize more sharply than the former.

[0003]

[Means for Solving the Problem]

1. a plurality -- a flat surface -- a rectangle -- \*\* -- a display panel -- these -- each -- a panel -- mutual -- between -- mutual -- adjoining each other -- having made -- a panel -- folding -- free -- becoming -- as -- connecting -- and -- the above -- each -- a panel -- a top -- in view of -- zigzag -- \*\* -- becoming -- as -- connecting -- a connection -- since -- the fold-up formula display characterized by having the tooth-back side connection which changes, and can fold up the tooth back further when each
  2. It is the fold-up formula display which the above-mentioned display panel consists of four or more sheets [ even ] in the above 1, and is characterized by what these are arranged for so that it may come to the internal-surface-of-parietal-bone side when it folds up mutually and a screen side folds up.
  3. It is the fold-up formula display further equipped with the flat-surface side connection connected so that it can do [ folding up from the center of one flat surface, or ] when the above-mentioned display panel consisted of three or more sheets further in the above 1 or 2 and each above-mentioned panel was folded up.
  4. Fold-up formula display further characterized by what field folded up by flat-surface side connection in first half is equipped with loudspeaker which generates microphone which collects user's voice, and voice for in the above 3 when each above-mentioned panel is folded up.
  5. Fold-up formula display characterized by what it has loudspeaker and microphone for radio performing conversation to background of field where it had the screen-display section of display panel of shape of flat-surface rectangle in which each has the screen-display section of at least two or more sheets, connection means to connect between each of these panels of both so that folding may become free mutually, and one of the above of display panels with others for.
- When at Least Three or More Flat-Surface Rectangle-like Panels and Each of These Panels Continue in the shape of a Flat Surface and are Put in Order, 6. The Edge Which Adjoins Each Other Mutually It connects so that bending and folding of the panel which adjoins each other mutually may become free. And a connection means to connect so that the side face of each panel may become abbreviation \*\*\*\*\*-like collectively in the phase which shifts to the status when developing each above-mentioned panel from the status when folding up mutually, On the panel located in any in the continuum of the connected panel, or one edge On the panel which the field which counters the user is equipped with the loudspeaker and microphone for holding

conversation with others by the radio, and constitutes other fractions of the above-mentioned continuum Fold-up formula display characterized by what the screen-display section is formed in the field which counters the user for, respectively.

[0004]

[Embodiments of the Invention]

Operation gestalt 1. view 1 (a) is the front view of the operation gestalt 1 of this invention, and drawing 1 (b) is the plan. As shown in drawing 1, this operation gestalt consists of four display panels 1 (for example, a liquid-crystal-display panel and organic EL (electro-luminescence) panel). Each of these panels 1 have screen 1a which displays the character and picture image, and tooth-back 1b of the opposite side. Compared with screen 1a, as for tooth-back 1b, the intensity is large. Although each panel 1 is omitting illustration, since it has the frame around the display screen, the display screen serves as the fraction except the frame of the periphery of each panel 1. However, with this operation gestalt 1, since the frame is formed so that it may become parvus area extremely, as for screen 1a of each panel 1, almost all the fractions serve as the display screen after all (therefore, in drawing 1, the above-mentioned frame is omitting illustration). Each panel 1 collaborates in this operation gestalt 1, and can consist of [ one screen of each other ] it now. Therefore, the user of the display which combined each of this panel 1 is one big screen on which each of these four panels 1 were put together, and can display one big picture image and a text. Between each panel 1 which adjoins each other mutually, it has the connections 2, such as the ginglymus which connects the panel 1 which adjoins each other mutually free [ folding ]. When each panel 1 is folded up, this connection 2 is constituted so that the screen 1a side of each panel 1 may be folded up inside mutually. That is, as shown in the drawing 2 and the drawing 3, when each panel is folded up, it comes to a internal-surface-of-parietal-bone side when screen 1a of each panel 1 with a weak intensity folds up, and screen 1a protects from impact etc.

[0005] Operation gestalt 2. next the drawing 4, the drawing 5, the drawing 6, and the drawing 7 are drawings showing the operation gestalt 2 of this invention. In addition to the configuration of the operation gestalt 1, the following configurations are taken with this operation gestalt 2. That is, the front view showing the status that drawing 4 (a) developed each panel of this operation gestalt 2, drawing as which drawing 4 (b) regarded it from the side face, and the drawing 4 (c) are the plan. Moreover, drawing 5 is a perspective diagram showing the phase in the middle of making it shift to the facing status from the status which folded up this operation gestalt 2. Moreover, drawing showing the status that drawing 6 (a) folded up this operation gestalt 2, and the drawing 6 (b) are drawings as which it was regarded from the orientation of arrow head A of drawing 6 (a). A total of eight panels 1 is connected with this operation gestalt 2. And it is the same as that of the operation gestalt 1 that it is coming inside and protected from external force when the screen 1a side's folds up. Furthermore, with this operation gestalt 2, as shown in drawing 7, when eight above-mentioned panels 1 are folded up and it becomes a "rectangular parallelepiped" collectively (status shown in drawing 6), it has the tooth-back side connection 4 further, so that two may be fractured and it can do from the center of tooth-back side 3 of the "rectangular parallelepiped." Thereby, the further miniaturization at the time of un-using it of display is attained, and a cellular phone becomes easier.

[0006] Based on drawing 11, the operation gestalt 3 of this invention is explained from operation gestalt 3., next the drawing 8. A plan when drawing 8 (a) develops this operation gestalt 3, drawing as which drawing 8 (b) regarded drawing 8 (a) from the top, and the drawing 8 (c) are drawings as which drawing 8 (a) was regarded from the orientation of arrow head C. Moreover, drawing 9 is drawing showing the status in the middle of making it shift to the status of expansion (spread) from the status that this operation gestalt 3 was folded up. Drawing 10 is drawing as which the status that this operation gestalt 3 was folded up was regarded from the tooth back. Drawing and the drawing 11 (b) showing the status that the status that drawing 10 folded up drawing 11 (a) was further bent so that the vertical orientation of the tooth back of drawing 10 might be carried out for 2 minutes are drawing showing the status that it folded up completely from the status of drawing 11 (a). In addition to the configuration of the operation gestalt 1, the following configurations are added with this operation gestalt 3. That is, with this operation

gestalt 3, the display panel 1 of a total of six sheets is used, and it has the connection 2 folded up so that a flat surface may become the letter of zigzag mutually (refer to [ the drawing 8 and ] the drawing 9 ). Next, with this operation gestalt 3, it has further the connection 5 for enabling it to make it 2 chip boxes from the center section (fraction shown by sign D of drawing 10 ) of each panel 1 which constitutes the flat surface of this "rectangular parallelepiped" about what folded up by the above-mentioned connection 2 and became the configuration of a "rectangular parallelepiped" collectively (pass the status of drawing 9 thing which changed into the status of drawing 10 ). If it fractures and carries out by this two more connection 5, it passes through the status of drawing 11 (a), and will be in the status of drawing 11 (b), and the further miniaturization is attained. Thus, with this operation gestalt 3, the further miniaturization at the time of un-using it of display is attained, and a cellular phone becomes easier.

[0007] Operation gestalt 4., next the operation gestalt 4 of this invention are explained from drawing 12 based on drawing 17 . Drawing 12 what folded up this operation gestalt 4 to the zigzag configuration like the operation gestalt 1 Drawing and the drawing 13 showing the status that it folded up like the operation gestalt 3 at 2 chip boxes Furthermore, the side elevation, Drawing showing an operation in the middle of in case drawing 14 develops "2 chip-box status" from the status folded up at 2 chip boxes as shown in the drawing 12 and the drawing 13 , Drawing and the drawing 16 showing the status when "2 chip-box status" is developed through an operation of drawing 14 , as for drawing 15 are drawing showing an operation the middle when developing in the "spread" status further from the status of drawing 15 to the above "the status folded up in the shape of zigzag." Drawing and the drawing 17 as which (a) regarded the perspective diagram and (b) from the top are drawing showing the status when developing in the facing status completely from the status of drawing 16 . with this operation gestalt 4, as shown in drawing 12 - view 15 , what two or more panels 31 and 36, and 32, 35, 33 and 34 are folded up, and changed into the status of drawing 15 carries out the upper half and lower half of drawing 15 by connections 37 and 38 further for 2 minutes -- as -- "2 chip boxes" -- it connects possible With this operation gestalt 4, as shown in drawing 17 , the display panel, 31, 32, 33, 34, 35, and 36, of six sheets is connected mutually. And the displays 31a, 32a, 33a, 34a, 35a, and 36a of these six panels collaborate mutually, and can constitute one big screen now. Although drawing 17 has indicated the displays 31a, 32a, 33a, 34a, 35a, and 36a of each panels 31, 32, 33, 34, 35, 36, and 37 as what has parvus area considerably rather than each panel In practice, since displays 31a, 32a, 33a, 34a, 35a, and 36a occupy most flat surfaces of each panels 31, 32, 33, 34, 35, 36, and 37 An user is hardly conscious of the mutual connection of each panels 31, 32, 33, 34, 35, 36, and 37. Therefore, for an user, one big screen sees by the displays 31a, 32a, 33a, 34a, 35a, and 36a of each panels 31, 32, 33, 34, 35, 36, and 37. Moreover, as shown in drawing 17 , with this operation gestalt 4, the illustration upper part of a panel 34 is equipped with a loudspeaker 42, and it has the microphone 41 underneath the panel 33. As shown in drawing 16 (b), from the flat surface of each panels 33 and 34, it projects and these loudspeakers 42 and microphones 41 bend, and they are laid underground or built in each panel like so that those tops may come on the same flat surface mostly with the flat surface of each panel. A total of six panels shown in drawing 17 is made to the type which is shown in the drawing 14 or the drawing 15 by folding up mutually. If it develops in the gestalt which is shown in this drawing 14 or drawing 15 , it can be used as a usual portable telephone. And a total of the six above-mentioned panels 31, 32, 33, 34, 35, 36, and 37 can be used as "display which has one in all big screen" by developing, as further shown in drawing 15 from the gestalt of drawing 14 , developing in the gestalt which is further shown in (a) of drawing 16 , and (b), and developing further in the gestalt which is shown in drawing 17 . Moreover, since the above-mentioned microphone 41 and the loudspeaker 42 exist continuously in the status which shows in drawing 17 horizontally on the same flat surface as each displays 35a, 32a, 36a, and 31a of other panels 35, 32, 36, and 31 namely, -- an user, using it as a portable telephone, carrying out a remote man and remote conversation using the above-mentioned microphone 41 and the loudspeaker 42 Simultaneously, "one in all big screen" which consists of each displays 35a, 32a, 36a, and 31a of each above-mentioned panel can be seen (that is, it is used also as display).

[0008] The operation gestalt 5 of this invention is explained based on operation gestalt 5., next the drawing 18 . With this operation gestalt 5, the edge of each other where two panels 51 and 52 adjoin each other mutually is connected by the connections 53, such as the ginglymus (or hinge), free [ bending and folding ]. Drawing and the drawing 18 (c) showing the operation in the middle of drawing and the drawing 18 (b) showing [ 18 ] the status that panels 51 and 52 were folded up (a) being developed by the facing status from the status of \*\* (a) are drawing showing the status that it was completely developed by the facing status. With this operation gestalt 5, screen-display section 51a which consists of LCD (LCD) etc. is attached in one field of a panel 51. Moreover, screen-display section 52a which changes since it is LCD etc. is attached in one field (field of the side which counters with the screen-display section of the above-mentioned panel 51 when bent between the above-mentioned panels 51) of a panel 52. moreover, in the field (field opposite to screen-display section 52a) of another side of a panel 52 the liquid-crystal-display screen 57 for carrying out character representation of the message from the ten key 56 for inputting the loudspeaker 54 for talking with remote others through a public line by the radio and the microphone 55, a partner point number to be dialed, etc., the name of the partner point, or the partner point -- and It has the start button 58 for starting or stopping the telephone call with the partner point etc. Moreover, the transmitter-receiver for transmitting and receiving data between remote telephone base stations is built in the interior of a panel 52. By the above, an user can use now the above-mentioned field (field of the opposite side of screen-display section 52a) of a panel 52 as a portable telephone. In addition, as it replaces with the above-mentioned ten key 56 and it has a keyboard for a hiragana input, or a touch panel (what carries out a data input with the finger point or an electronic pen), you may be made to make the memory which records the address book containing the data of the partner point telephone number further build in with this operation gestalt 5. Thus, if constituted, an user will input keywords, such as an identifier of the partner point which is going to telephone, by the above-mentioned keyboard or the touch panel, and will search the telephone number of the partner point from the above-mentioned address book based on this keyword. When the identifier and the telephone number of the partner point are displayed on the liquid-crystal-display screen 57 (refer to the drawing 18 ) and an user issues designation of O.K., you may be made to make the telephone number of the partner point send automatically. as mentioned above -- according to this operation gestalt 5 -- one carried type (a notebook size or note size) information device -- portable telephone \*\*\*\*\* -- it can be used (in the status which shows in drawing 18 (a)) -- it can be used also as display with the display screen of a facing big size by developing in the spread status (referring to drawing 18 (b)) -- it becomes like (status shown in drawing 18 (c)) Namely, the display panel 51.52 of the shape of a flat-surface rectangle of two sheets in which each has the screen-display sections 51a and 52a with this operation gestalt 5, The connection 53 which connects the edge where each of these panels 51 and 52 adjoin each other mutually so that folding may become free mutually, Since the field of the background of screen-display section 52a of the above-mentioned display panel 52 is equipped with the portable telephone which has the loudspeaker 54, the microphone 55, etc. for telephoning to remote others by the radio The pocket information device which doubles and has the function of both with the display which has a portable telephone and "one in all big screen" can be realized now.

[0009] Operation gestalt 6., next the operation gestalt 6 of this invention are explained based on drawing 19 . So that this operation gestalt 6 may be in the status (refer to drawing 19 (c)) that it was arranged succeeding the time of three panels 61, 62, and 63 being placed in the shape of a flat surface (when developed by the "spread status") The connections 64a, 64b, 65a, and 65b to which it is arranged so that each other may be adjoined mutually, and those edges that adjoin each other mutually change from the ginglymus (hinge) etc. connect free [ bending and folding ]. Moreover, as shown in drawing 19 (b) and (c), when developed by the above-mentioned "spread status", the screen-display sections 62a and 63a which change from LCD etc. to the field of the side which is visible to an user are attached in the above-mentioned panels 62 and 63, respectively. Moreover, as shown in drawing 19 (a), (b), and (c), when the above-mentioned panel 61 develops at the above-mentioned "spread status", the field of the side which is visible to an user is equipped with a loudspeaker 66, the microphone 67, the ten key 68, the display screen 69, and the start button 70

(these loudspeakers, microphones, etc. are the same as that of the thing in the operation gestalt 5 shown in drawing 19 ). Thereby, the above-mentioned field (field of the side which follows the same flat surface as the screen-display sections 62a and 63a, and appears when made the above "the spread status") of the above-mentioned panel 61 can be used now as a portable telephone. As shown in drawing 19 (c), when each panels 61, 62, and 63 are changed into the facing status, with this operation gestalt 6, an user can also telephone to remote others using the portable telephone attached in the panel 61 while it is used as display which has "one in all big screen" using the screen-display sections 62a and 63a. Moreover, an user inputs a character, a graphic, and a picture image in the state of the spread of drawing 19 (c) using the screen-display sections 62a and 63a on the left of [ the ] illustration, telephoning to remote others using the above-mentioned portable telephone, and he can also transmit the data of the content of an input to the partner point which is talking over the telephone, talking over the telephone. Moreover, when not using this operation gestalt 6, an user is in the status compactly folded up as shown in drawing 19 (a), and can put in and carry in the pocket of dress etc. and the time of an user wanting to use it only as a portable telephone -- above -- "what (refer to drawing 19 (b)) is developed in the spread status" -- there is nothing and it can talk over the telephone with the status that it folded up as shown in drawing 19 (a) In addition, it is the same as that of the place mentioned above about the operation gestalt 5 that it may be made to make the memory which records the address book containing the data of the partner point telephone number further build in as it replaces with the above-mentioned ten key 68 and it has a keyboard for a hiragana input or a touch panel (what carries out a data input with the finger point or an electronic pen). As mentioned above, with this operation gestalt 6, the edge of three flat-surface rectangle-like panels 61, 62, and 63, each of these panels 61 and 62, and 63 comrades which adjoins each other mutually so that folding may become free mutually And the connections 64a, 64b, 65a, and 65b connected so that the side face of each panels 61, 62, and 63 may become abbreviation \*\*\*\*\*-like collectively in the phase which shifts to the status when it develops from the status when folding up, On the panel 61 located in the illustration right end in the continuum (refer to drawing 19 (c)) of the connected panel The screen-display sections 62a and 63a are formed in the panels 62 and 63 which it has the equipment of portable telephones, such as the loudspeaker 66 for holding conversation with others by the radio, and the microphone 67, and constitute other fractions of the above-mentioned continuum, respectively. Therefore, while an user can use one pocket information device as a portable telephone, the merit which has "one in all big screen" that it can be used also as display is obtained.

[0010]

[Effect of the Invention] According to this invention, the display miniaturized more sharply than the conventional fold-up formula display can be offered. The display panel of the shape of a flat-surface rectangle in which each has the screen-display section especially of two or more sheets, The connection which connects the edge of each of these panels which adjoins each other mutually so that folding may become free mutually, Since the field of the background of the screen-display section of the above-mentioned display panel is equipped with the loudspeaker and microphone for telephoning to remote others by the radio The pocket information device which doubles and has the function of both with the display which has a portable telephone and "one in all big screen" can be realized now. Moreover, especially, the panel of the shape of a flat-surface rectangle of three or more sheets, and the edge of each of these panels which adjoins each other mutually so that folding may become free mutually And the connection connected so that the side face of each panel may become abbreviation \*\*\*\*\*-like collectively in the phase which shifts to the status when it develops from the status when folding up, On the panel located in any in the continuum (refer to drawing 19 (c)) of the connected panel, or one edge On the panel which it has the loudspeaker and microphone for holding conversation with others by the radio, and constitutes other fractions of the above-mentioned continuum When the screen-display section forms, respectively, while an user can use one pocket information device as a portable telephone, the merit which has "one in all big screen" that it can be used also as display comes to be obtained.

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[Translation done.]